BIOC 122 : FUNDAMENTAL CONCEPTS IN BIOLOGY Fall 2014
9:25-10:40 Tuesdays & Thursdays, RZR 123
Instructor: David R. Caprette, Ph.D., Department of BioSciences

Why do I teach this course?

"All that stuff I was taught about evolution, embryology, the Big Bang theory, all that is lies straight from the pit of hell."

U.S. Rep. Paul Broun, R-Ga
September 27, 2012

Broun, *a medical doctor by training*, believes that the earth is less than 9000 years old and that everything was created in six literal days. He has served on the House Committee on Science, Space and Technology!

We must not expect our leaders to be any better informed or rational than the majority of their constituents. Therefore my overall goal is to help produce informed citizens when it comes to important issues related to science and technology and, in particular, biological science.

In the syllabus, I have listed several major learning objectives toward achievement of that goal. These objectives are far more about learning concepts and ways of thinking than they are about remembering facts. I hope that you will enjoy this approach to learning science and that Bioc 122 becomes one of your favorite courses at Rice.

Very truly yours,

David R. Caprette

Learning goals, policies, schedule

Course learning goals

No concepts are more fundamental to biology than common ancestry and natural selection (i.e., evolution). Physical explanations for the formation of the earth, appearance of life on earth, and origin of species are common themes that will run throughout the course. Regarding these explanations, each student should be able to:

- cite the evidence
- explain how the evidence led to the explanation
- explain the faulty reasoning behind myths and misconceptions surrounding the explanation

In addition, each student should be able to correctly explain what is mean by a scientific theory. Each student must be able to distinguish what is in the realm of science from what is not in the realm of science, and to be able to distinguish what a theory claims from what it does not claim.

Objective 1: Obtain a working knowledge of fundamental concepts in biology

- learn the respective roles of types of macromolecules in living cells
- learn the roles of organelles in the function of cells, tissues, organs, and organisms
- learn the fundamentals of gene expression
- be able to provide the evidence and reasoning behind the theories of common ancestry (a.k.a., descent with modification or, simply, evolution) and natural selection

Objective 2: Develop scientific literacy, namely an understanding of the nature, process, and relevance of science

- learn to apply skepticism of a scientist
- learn to distinguish scientific fact from fiction, theory from conjecture, valid from spurious arguments
- be able to cite examples of the slow, deliberate, progressive nature of science

Objective 3: Understand the consequences of gene expression

- be able to explain how gene expression leads to phenotypes, including complex and monogenic traits
- be able to explain long term changes in gene expression in the form of evolution of new species
- be able to cite examples of normal changes in gene expression, e.g., during development
- be able to cite examples of how gene expression can go wrong - e.g., cancer as an example of uncontrolled gene expression

Objective 4: Obtain access to credible sources of information in biological and biomedical science

- be able to access information from PubMed, BLAST, and similar web-based indexes
- be able to distinguish reliable sources of information from questionable sources
- with guidance, read and understand at least one article from the primary literature

Policies, Topics, and Activities for Fall 2014

This course is primarily a "lecture" course, however we will frequently employ hands-on activities and group work. We will start with an introduction to the light microscope and a laboratory experience using the microscope, then work with some basic concepts concerning the biology of cells, tissues, and organs. We will then launch into the main themes starting with the process of science, possible origins of life on earth, evolution of species, genetics of complex traits, and special topics in biology. Learning in this course will be centered around class meetings, thus your *on time* attendance is essential. Most classes will require advance preparation. In class we will employ an audience response system (iClicker) as an additional learning tool.

Course instructor

Dr. David Caprette, ABL 327 (Anderson Biological Laboratories, third floor), 713-348-3498, caprette@rice.edu, office hours 11 am to 1 pm Monday, Tuesday, and Thursday or by appointment. Please notify Dr. Caprette of any problem concerning attendance, grading, or course materials.

Policies

Grading

- Pre-class preparation, attendance, and minute questions, 40%
  - Each pre-class preparation assignment, day's attendance, and minute question counts equally toward the total.
- Homework assignments (Tests & Quizzes), 60%
  - Each homework assignment counts equally

Grade cutoffs are as follows: ≥ 97% = A+; 93-97 = A; 90-93 = A-; 87-90 = B+; 83-87 = B; 80-83 = B; 77-80 = C+; 73-77 = C; 70-73 = C-; 67-70 = D+; 63-67 = D; 60-63 = D-

Pre-class preparation. Most classes will require completing a pre-class assignment in Tests & Quizzes. The questions are designed to make you think and to ready you for a classroom discussion. A few of the pre-class assignments will be graded and a score recorded. Graded assignments will be identified as such.

- You will receive full credit for a pre-class assignment if you complete all of the questions (correctly, if the assignment is graded) and attend the corresponding class
- If you complete a pre-class assignment but miss the corresponding class, then the assignment will not count toward your course grade
- If you fail to complete a pre-class assignment a zero will be recorded

Attendance. In class we will conduct group work, discussions, and hands-on activities to go along with the lecture material. We will also use "clicker slides" with an audience response system to check your understanding of concepts and to address misconceptions. Every student is expected to arrive on time each day with a working i>Clicker+ handset. You will receive a score of 100% for on-time attendance.

Minute questions. Some classes will begin with a question either on material to be reviewed before class or on material covered by a previous class. Students will be given 1 to 3 minutes to answer the question on an index card that will be passed out at the start of class. Minute questions will be graded. Missed minute questions cannot be made up.

Homework assignments. All homework assignments will be completed on Owl-Space and will become available at least one week before they are due. Questions will be a mix of short answer/essay and multiple choice questions. The due date for each homework assignment is posted in the course syllabus. It is advisable to start early in case there is a connection failure. The assignments are not timed and answers can be saved and an assignment re-visited repeatedly prior to submission.

Absences, late arrivals, and late assignments. Legitimate excuses for missing class include circumstances beyond your control such as illness, death in the family, travel for athletics, graduate school interviews, etc. I may or may not require written documentation to support an excused absence. Students arriving late to class will receive partial credit for attendance. Any student experiencing a problem submitting an assignment must contact the instructor immediately. Ten percent of the available score will be deducted per day an assignment is late.

Instructor feedback. I will do my best to grade each assignment within a week of submission and will provide feedback on most of the questions (and all answers that do not receive full credit) when I release the grade.

Resources. There is no textbook for this class. Each Powerpoint presentation listed in the syllabus will be posted as a pdf immediately following the corresponding presentation. Links to web resources and additional files such as "handouts" will also be posted in the Resources section.

Honor code specifics All assignments are "open resource," meaning that students may have access to their notes, posted resources and other reference materials while working on an assignment. You must answer homework questions in your own words. Do not plagiarize. For example, you must not answer a question with a quotation from a web site. Please consult the document on plagiarism that I've posted in Resources if you are not sure what does or does not constitute plagiarism. Students must work individually on assignments posted in Tests & Quizzes, with no assistance from other students unless otherwise noted.

Students with disabilities Any student with a documented disability needing adjustments or accommodations is requested to

speak with the course coordinator during the first two weeks of class. All discussions will remain confidential. Such students should also contact Disability Support Services in the Ley Student Center.

Schedule

BIOC 122 will meet Tuesdays and Thursdays from 9:25 am to 10:40 pm in Rayzor Hall Rm. 123. Your instructor will conduct most of the classes. One or more presentations may be conducted by invited speakers with expertise in their chosen fields. This schedule is subject to change, including speakers and presentations, addition of pre-class assignments, and possible changes to listed assignments. Thursday Oct 30 has been set aside as an open date for catching up in case we fall behind in the schedule.

* tentatively scheduled
Green – to be completed before class
Blue – assignment due by the end of the day (midnight)
Red – holiday or break

Day/date	Topic	Assignment(s)	Resource(s)
Tues Aug 26	The light microscope as an instrument for studying biology	• Complete the pre-class preparation for Day 1 ("Day 01 Preparation," in Tests & Quizzes) • Have an i>Clicker+ handset ready to go before class; register your clicker (Tests & Quizzes)	Two_eyes.pdf
Thurs Aug 28	Microscopy laboratory, ABL 141	• Peruse the resource in advance of class	Why_we_don't_drink.pdf
Tues Sep 2	Organize groups, introductions, group behavior exercise, research on cell organelles	• Peruse the resource in advance of class • Complete "Day 03 preparation" • Bring a laptop and/or general biology text if available	Sweet_16_S14.pdf
Thurs Sep 4	Organelles "sweet 16" tournament	• Complete "Day 04 preparation"	Sweet_16_S14.pdf
Tues Sep 9	Organelle review & some rather interesting facts regarding metabolism	• Complete "Day 05 preparation" • HW1: Microscopy	Thin_air.pdf
Thurs Sep 11	Properties and biological importance of water	• Complete "Day 06 preparation"	Sixty_percent.pdf
Tues Sep 16	Bone, blood, circulation	• HW2: Cells & organelles	Red_stuff.pdf
Thurs Sep 18	The process of science	• Complete "Day 08 preparation"	Science.pdf
Tues Sep 23	Evolution of the universe, origin of life on Earth	• HW3: Properties of water • Complete "Day 09 preparation"	Origins.pdf
Thurs Sep 25	Origin of species – evidence for descent with modification	• HW4: Bone, blood, and circulation • Complete "Day 10 preparation"	Change.pdf

Tues Sep 30	Origin of species – evidence for natural selection	• HW5: Process of science • Complete "Day 11 preparation"	Fitness.pdf
Thurs Oct 2	Evolution of Altruism	• HW6: "Origins"	Altruism.pdf
Tues Oct 7	Genetics pt. 1 – Phenotypes, genotypes, and chromosome theory	• Complete "Day 13 preparation" (start early – you may have to do some background research)	Dodger.pdf
Thurs Oct 9	Finish Genetics pt. 1	• HW7: Origin of species	Dodger.pdf
	Mid-term recess – no classes Oct 13-14		
Thurs Oct 16	Genetics pt. 2 – Discovery of DNA	• Complete "Day 15 preparation" with the aid of the recommended on-line videos (extended to Oct 21, late penalty applies)	Photo_51.pdf
Tues Oct 21	Genetics pt. 3 – DNA replication, transcription, translation, and the central dogma	• HW8: Genetics pts 1 and 2	Dogma.pdf
Thurs Oct 23	Genetics pt. 4 – Mutations, human genetic diseases, pedigrees	• Complete "Day 16 preparation"	Woody.pdf
Tues Oct 28	Finish Genetics pt. 4	• Complete "Day 17 preparation"	Woody.pdf
Thurs Oct 30	Genetics pt. 5 – An introduction to gene regulation		Altitude.pdf
Tues Nov 4	Finish Genetics pt. 5 and wrap up, inlcuding Belyaev's arctic fox experiment	• HW9: Genetics pts 3 and 4	Altitude.pdf, Foxes.pdf
Thurs Nov 6	Developmental biology pt. 1	• Complete "Day 20 preparation"	Immortality.pdf
Tues Nov 11	Developmental biology pt. 2		Sex.pdf
Thurs Nov 13	Neuroscience pt. 1	• Complete "Day 23 preparation" • HW10: Genetics parts 5 and 6	Animal_electricity.pdf
Tues Nov 18	Neuroscience pt. 2		Learning.pdf
Thurs Nov 20	Neuroscience pt. 3	• HW 11: Development pts. 1 and 2	Perception.pdf
Tues Nov 25	Bacteria, viruses, and antibiotics	• Complete "Day 26 preparation" • HW12: Neuroscience	Resistance_is_futile.pdf
	Thanksgiving break – no classes Nov 27-28		

Tues Dec 2	Cancer and tissue regeneration	• Complete "Day 27 preparation"	Cancer.pdf
Thurs Dec 4	Personal genomics	• HW 13: Bacteria, viruses, and antibiotics	Who_are_you.pdf
Thurs Dec 11		• HW 14: Cancer, Tissue Regeneration, and Personal Genomics	